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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

WATER FACILITIES OPERATIONS GUIDANCE REPORT
FOR THE
CANADIAN RIVER BASIN
NEW MEXICO

February 1942

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WATER FACILITIES OPERATIONS GUIDANCE REPORT
FOR THE
CANADIAN RIVER BASIN IN
QUAY COUNTY, NEW MEXICO

WATER UTILIZATION PLANNING SERVICE
BUREAU OF AGRICULTURAL ECONOMICS

Under the Provisions of the
Water Facilities Act
(Public Law No. 399, 75th Congress)

February 1942

UNITED STATES DEPARTMENT OF AGRICULTURE

Bureau of Agricultural Economics

Washington, D. C.

Mr. George R. Phillips, Chairman
Water Facilities Board
Washington, D. C.

Dear Mr. Phillips:

The Water Facilities Operations Guidance Report for the Canadian Basin in Quay County, New Mexico was prepared by the Water Utilization Planning Service. Harold B. Elmendorf, Regional Water Utilization Supervisor, was responsible for immediate field supervision and preparation of the plan.

Julius F. Houser, Assistant Water Planning Analyst, made the field investigations and prepared the sections on geology and ground water.

The physical survey of the proposed Newkirk Project lands was made by Burnell G. West, Junior Soils Technologist of the Soil Conservation Service.

The report was reviewed in the Washington office by Chester C. Hampson, Senior Water Planning Analyst, and Kenneth O. Bayard, Water Planning Analyst.

Very truly yours,

Homer M. Wells

Homer M. Wells, Head
Water Utilization Planning Service

AUTHORIZATION

This report has been prepared under authority of the Water Facilities Act (Public 399, 75th Congress) approved August 28, 1937 and in accordance with the Water Facilities Procedure Manual of December, 1940. The area covered is the northern part of the Extension of the original Quay-Curry Area which was authorized for concurrent planning and operations by the Water Facilities Board on December 21, 1939, notification of this action being contained in New Mexico State Memorandum No. 12, dated January 18, 1940.

ACKNOWLEDGMENTS

This report is essentially a compilation of all available data supplemented by field investigations. Liberal use has been made of information, both published and unpublished, from the following sources:

State Engineer of New Mexico
New Mexico Extension Service
New Mexico Highway Planning Survey (Base Maps)
U. S. Geological Survey
Bureau of Reclamation
U. S. Weather Bureau
Corps of Engineers, U. S. Army
Soil Conservation Service
Bureau of Agricultural Engineering
Works Projects Administration

Considerable information was furnished by the Quay County Land Use Planning Committee, which is gratefully acknowledged.

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SUMMARY

This report covers the Canadian Basin in Quay County, New Mexico, with an area of 2,390 square miles. The basin conforms closely to the county boundaries, except that the headwaters of Pajarito Creek extend into Guadalupe County and that area is embraced in this discussion. To enable the Agricultural Planning Committees to plan water utilization effectively in Quay County, 80 square miles in the southwest corner are included, though they drain into two minor tributaries of the Pecos River.

This report is restricted to an inventory of the water resources of this area, their present uses and their potential development. For a description of the county, an inventory of its land resources, discussion of the many economic and social factors affecting agriculture, and recommendations pointing the directions in which adjustments in land use appear desirable, reference can be made to a report now in preparation by the Division of Land Economics, BAE, and the New Mexico Experiment Station.

No irrigation is practiced in the Canadian Basin in Quay County, but works are being constructed by the Bureau of Reclamation for the irrigation of some 45,000 acres near Tucumcari. The water supply will be derived from the Conchas Reservoir, which impounds the flow of the Canadian River.

The principal tributaries of the Canadian River in Quay County are Pajarito and Tucumcari Creeks, the latter being formed by the juncture of Plaza Larga and Barranca Creeks. None of the tributaries is perennial except for short reaches where the channels have been cut below the water table.

In some parts of the county one of the major problems is the securing of satisfactory farmstead and stock wells. Map 2 shows all available information on the occurrence of and the depths to ground water. This map and the discussion of the Areal Geology and Ground Water are not limited to the Canadian Basin, but cover the entire Quay County, to enable the Agricultural Planning Committees to get a comprehensive picture of this resource.

Only one License to Appropriate water has been issued in Quay County, and that was for railroad water supply. The Pajarito Water Users Association has been issued a permit for an irrigation project near Newkirk. Reservations of water have been made by the Bureau of Reclamation in the Canadian River in Conchas Reservoir, and in Revuelto, Plaza Larga and Pajarito Creeks, all for the Tucumcari Project. The Bureau has also reserved water in Ute Creek for the proposed Logan Project, most of which is in Quay County.

Five reservoir sites have been suggested in this basin, one on upper Pajarito Creek for the proposed Newkirk Project and the others in connection with the Tucumcari Project.

The Newkirk Project contemplated the construction of a 2,650 acre-foot reservoir on upper Pajarito Creek and the irrigation of

1,000 or more acres near Newkirk, in Guadalupe County. The water supply appears adequate for less than 500 acres; the cost, estimated in 1940 at $72,727, would be $145 per acre for 500 acres; the soil does not seem adapted to long-continued irrigation; and neither the application nor the permit which has been issued mention the right to build a storage dam or to store water. This project would be above the $50,000 statutory ceiling of the Water Facilities Program and its development is highly questionable under any program.

RECOMMENDATIONS

There do not appear to be any practical opportunities for irrigation from ground water within the Canadian River Basin in Quay County, nor by the use of surface water except under the Tucumcari Project. Considerable flood waters are discharged by the major tributaries but no locations are known where they can be diverted at reasonable expense onto irrigable lands. If more favorable situations are found, flood irrigation may be developed but only as a supplement to an established enterprise such as livestock production and not as the sole dependence for livelihood. In addition, there are opportunities for water-spreading measures in normally dry watercourses, primarily for erosion control.

Where springs are found with a discharge adequate for irrigation of a small acreage that would prove a valuable adjunct to an established stock ranch, facilities should be installed under proper conditions for their utilization.

Farmstead water facilities, preferably wells, should be installed wherever the need exists, where the enterprise is of a reasonably permanent nature and compatible with the established regional economy, and where satisfactory ground-water supplies can be secured. Map 2 shows the available information on occurrence of and depths to ground water. Where satisfactory farmstead wells cannot be obtained, the feasibility of small surface reservoirs, equipped with filters to provide water suitable for domestic use, should be investigated.

The basin is fairly well provided with stock water where ground-water supplies are readily accessible, but some parts of the area are deficient and should be supplied with additional facilities. Wells should be installed where there is reasonable assurance that ground-water can be secured at reasonable depths. Stock tanks should be restricted to those instances where they will furnish a water supply with the same degree of reliability as wells, and at less cost.

PURPOSE AND SCOPE

The original intention was to prepare a complete inventory of the land and water resources of that part of the Canadian River watershed which is located within Quay County, New Mexico, and to offer a plan for the development and rehabilitation of facilities which would promote a more effective utilization of those resources. Soon after authorization for area planning under the Water Facilities Program, a land-classification study was initiated by the Division of Land Economics, BAE, and the New Mexico Experiment Station, in cooperation with the Quay County Agricultural Planning Committee. That project is making an inventory of the land resources and an analysis of the many economic and social factors which influence the use of land in this county. One result will be a generalized classification of agricultural lands with a view to pointing the directions in which adjustments in land use will be desirable. The report will also make general recommendations in regard to size of farms, unit organizations, farming systems, and other phases of the general land-use pattern. It is now in its final stage and will soon be available to the operations agencies and the Agricultural Planning Committees.

Because of that study there is no necessity for a complete Water Facilities area plan. To avoid duplication of effort, investigations under the Water Facilities Program have been restricted to the surface and ground-water resources of the Canadian Basin in Quay County, their

present uses, and their potential development. This report discusses these factors and contains recommendations for operations under the Water Facilities Program. All other phases of land use have been omitted and agencies interested in them can refer to the above-mentioned report on land classification in Quay County. The securing of adequate water supplies for farmstead and livestock needs has long been a major problem in Quay County. Hence the chief emphasis in this study was originally on the ground-water resources, particularly because there is apparently little opportunity for irrigation outside of the Tucumcari Project. Local interest in a proposed irrigation project on the upper Pajarito Creek has led to the comprehensive discussion regarding surface-water resources and their potential utilization.

The drainage basin of the Canadian River and its tributaries in Quay County conforms closely to the boundaries of the northern part of the county, except in two instances. The headwaters of Pajarito Creek extend about 15 miles west into Guadalupe County and an irrigation project is proposed in that portion of the watershed. For convenience and a better analysis of the surface-water utilization, this discussion covers this upper Pajarito Basin with the remainder of the watershed in Quay County. The second case is in the southwest corner of the county, where some 80 square miles drain into Alamogordo and Truchas Creeks, both of which are minor tributaries of the Pecos River. The first flows into the Alamogordo Reservoir, while the second enters the Pecos River at Fort Sumner. There are no known possibilities for utilization of surface water along these streams and their upper watersheds are included in this report

only to enable the Agricultural Planning Committees to round out their study of the ground-water resources of Quay County. Although the southern portion of Quay County was covered by the Water Facilities Area Plan for the Quay-Curry Area, published in August, 1939, Map 2 gives ground-water information for the entire county. The additional data was provided to enable the Agricultural Planning Committees to get a comprehensive picture of the occurrence of ground water.

The developments recommended under the Water Facilities Program will go only part of the way towards a fully coordinated utilization of land and water for the benefit of the people in Quay County. They will supplement the many other adjustments which must be attained through other means. Since the investigations on which these recommendations are based was of a reconnaissance nature and social and economic conditions in the watershed may change considerably in the future, this report must be considered only as a general guide to water development in the near future.

DESCRIPTION OF THE AREA

Location and Description

The Canadian Basin in Quay County is on the eastern border of New Mexico and is largely a rolling prairie country, with annual precipitation of 15 to 18 inches, of which 12 to 15 inches is received during the growing season. Snowfall will average between 15 and 25 inches. Temperatures average about 57 degrees, with a maximum well above 100 and a minimum of slightly below zero for brief periods. Elevations vary from 3,900 to 4,500 feet above sea level, with a few isolated buttes which extend above 5,000 feet. The Canadian Basin in Quay County is devoted to dry-farming and range. The principal crops are grain and forage sorghums, corn broom corn, beans and Sudan grass. Grass production is usually good and stock raising is one of the main sources of income.1/

There is no irrigation at this time in this basin, but works are now being constructed by the Bureau of Reclamation for the irrigation of approximately 45,000 acres of land in the Arch Hurley Conservancy District at Tucumcari. This project will derive its water supply from the Conchas Reservoir and, when it is in full operation, will probably make a material change, the nature of which cannot be accurately predicted, in the economy of this basin. For simplification, this project will hereafter be referred to as the Tucumcari Project, as it is carried by that name on the records of the Bureau of Reclamation.

1/ Abstracted from Climate as it Affects Crop and Ranges in New Mexico, Bulletin 182, New Mexico Experiment Station, 1939, p. 47

For a more complete and detailed description of Quay County, reference can be made to the above-mentioned report by the Division of Land Economics and the New Mexico Experiment Station.

Topography and Drainage Pattern

The area covered by this water utilization plan is approximately 2,470 square miles, of which 2,390 are in the Canadian Basin and some 80 square miles drain into the Pecos River.

The Canadian Basin is bounded on the south by the precipitous bluffs which rise to the plateau known as the Southern High Plains. The Canadian Valley proper is flat to moderately rolling and has little relief except in the vicinity of the Canadian River and its major tributaries. The southern tributaries rise on the edge of the High Plains, where they have steep gradients and have cut deep canyons. Large areas in some parts of the basin are very sandy. This feature and the lack of decided relief result in a very low percentage of the precipitation appearing as stream discharge.

The largest tributaries are Pajarito and Tucumcari Creeks which drain the southwestern half of this area, the latter being formed by the juncture of Plaza Larga and Barranca Creeks. Ute Creek joins the Canadian River along the northern border of the county. Since it flows only three miles in Quay County, its catchment area is excluded from this report, except for mention of the proposed Logan Irrigation Project which would

derive its water supply from a reservoir to be constructed on or near Ute Creek, some distance above its mouth. Eleven per cent of the entire watershed is in closed basins from which there is no surface drainage, leaving approximately 2,100 square miles which contribute to the Canadian River. Table 1 gives the approximate catchment areas of the major sub-basins. Their limits conform very closely to the boundaries of Quay County except in one instance. The headwaters of Pajarito Creek occupy 170 square miles in Guadalupe County.

None of the tributaries is truly perennial, although in some short reaches they have cut deep enough to intercept the water table. Practically all surface water occurs as flash floods, which are unpredictably in occurrence and usually of short duration.

Table 1

DRAINAGE BASINS IN QUAY COUNTY

Watersheds	Drainage Basin 1/ (Square Miles)	
Canadian River Watershed		2,390
Main Stem	190	
Pajarito Creek	500	
Tucumcari Creek	790	
Plaza Larga Creek (435)		
Barranca Creek (200)		
San Juan Creek	325	
Rana Canyon	105	
Miscellaneous Tributaries	215	
Non-contributing areas 2/	265	
Pecos River Watershed		80
Alamogordo Creek	30	
Truchas Creek	50	

1/ Planimetered from base maps of the New Mexico Highway Planning Survey. Boundaries checked by hasty field inspection.

2/ Owing to lack of physiographic relief, boundaries could not be accurately delineated and were often arbitrarily established for this purpose. for which the drainage was debatable were included in the tributary basin to which they appeared to contribute occasionally.

Irrigation Requirements

No adjudications or other determinations have been made by legally constituted authorities to establish the irrigation requirements in Quay County. Table 2 shows various estimates that have been made in this connection. As no experimental data are available for this area or for an area of similar climatic conditions, these estimates were based on comparison with other irrigation projects, tempered by the experience of the authors.

In the absence of authorative data it appears wise to accept the estimate of 2.0 acre-feet by the Bureau of Reclamation. Inasmuch as it is a common practice to irrigate some crops outside of the frost-free seasons, it is likely that the monthly distribution estimated by Fortier and Young for the Western Panhandle of Texas will be nearer the prevailing conditions after irrigated agriculture becomes established.

It was estimated that reservoir releases for the Tucumcari Project would average 3 acre-feet per acre.1/ A conveyance loss of one-third of the released water is in line with experience on other irrigation projects, though it would be greatly reduced where the irrigated land is adjacent to the source of supply as would be the case if springs are used. If any opportunities are found for irrigation outside of the Tucumcari Project, the gross irrigation or diversion requirements would probably fall between the last two columns in Table 3, depending on the length and condition of the distribution system.

1/ Keimig, J. A. and Mutch, H. V., Bureau of Reclamation, unpublished report on Tucumcari Project, August, 1937, p.58.

Table 2

ESTIMATED NET IRRIGATION REQUIREMENTS - TEXAS AND NEW MEXICO
Monthly distribution, percentage of annual requirements:

	Northeastern New Mexico 1/	Western Pan-handle, Texas 1/	Tucumcari Project 2/	Tucumcari Project 3/
January	—	—	—	—
February	1	—	—	—
March	5	4	—	—
April	14	7	16	17
May	22	14	16	15
June	26	25	20	19
July	17	23	20	21
August	8	15	18	17
September	4	9	10	11
October	2	3	—	—
November	1	—	—	—
December	—	—	—	—
Annual net requirements, acre-feet per acre,	1.60	1.65	2.0	2.0

1/ Fortier, Samuel and Young, Arthur A., Irrigation Requirements of the Arid and Semiarid Lands of the Southwest, Technical Bulletin No. 185, June, 1930, Table 5, p. 56.

2/ Keimig, J. A. and Hutch, H. E., Bureau of Reclamation, unpublished report on Tucumcari Project, August, 1937, p. 58.

3/ Estimated by Corps of Engineers, U. S. Army, quoted by Keimig and Hutch, p. 58.

Table 3

ESTIMATED IRRIGATION REQUIREMENTS - QUAY COUNTY, NEW MEXICO

	Per cent of Annual Total	Net Requirements (Acre-feet per acre)	Gross Requirements (Acre-feet per acre)
March	4	.08	.12
April	7	.14	.21
May	14	.28	.42
June	25	.50	.75
July	23	.46	.69
August	15	.30	.45
September	9	.18	.27
October	3	.06	.09
Annual Total		2.00	3.00

Hydrology

Surface Water Supply

At various times the following gaging stations have been maintained on the Canadian River and its major tributaries in or near Quay County. The location of these stations is shown on Map 3. The numbering is arbitrary and assigned only for reference in this report. 1/

Gage No. 1 was located on the Canadian River at Sanchez, New Mexico. The record extends only from May 1912 to July 1915.

1/ As this report goes to press it is learned that the Bureau of Reclamation is installing the following gages to measure the discharge of several tributaries of the South Canadian River in this vicinity.

Stream	Location of Gage	Gage Installed
Revuelto Creek	Sec. 13 - T. 15 N. - R. 33 E.	Oct. 26, 1941
Plaza Larga Creek	Sec. 22 - T. 10 N. - R. 31 E.	Nov. 7, 1941
Pajerito Creek	Sec. 12 - T. 10 N. - R. 26 E.	Nov. 15, 1941
Ute Creek	Sec. 35 - T. 14 N. - R. 32 E.	Being installed on Dec. 12, 1941
Bull Canyon	Sec. 16 - T. 10 N. - R. 27 E.	Installation proposed

Gage No. 2 is near the Bell Ranch headquarters. The Sanchez gage was moved to this location in July 1915 and operated until July 1917. It was reestablished in August 1927 and data on the Canadian River discharge have been collected to the present time.

Gage No. 3, on the Canadian at Logan, was operated from December 1908 to May 1914. After a lapse of several years, measurements have been taken from October 1922 to the present time.

Gage No. 4 was at the mouth of Ute Creek. This record extends only from August 1904 to May 1914 and was intermittent during that period.

There are so many diversions for irrigation in the headwaters of the Canadian River that none of the above cited discharge records will give the virgin unit run-off directly. The record at the mouth of Ute Creek would be of considerable value if it were not so short. Comparison of the Canadian River measurements at the Bell Ranch and at Logan over an 11 year period of simultaneous records, shows a mean annual discharge of 163,287 acre-feet for the 4,800 square miles of catchment area contributing to the Canadian between those stations. The unit run-off averages 34 acre-feet per square mile. Although this is the residual discharge, there are only about 1,000 acres irrigated along upper Ute Creek. 1/

The mean annual residual discharge at Logan was .48 inches over the 1,200 square miles above that point. After adjusting for irrigation diversions in the headwaters, the Corps of Engineers estimated the virgin watershed yield at 0.67 inches. The unit run-off,

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1/ House Document No. 308; P. 845

therefore amounts to 36 acre-feet per square mile, four per cent of the average precipitation of 16.83 inches over the upper basin. 1/

A reservoir has been proposed on Pajarito Creek about seven miles west of Tucumcari as part of the plan for the Tucumcari Project. It was estimated that the mean annual water yield from the 350 square miles of drainage basin above this site averages 0.67 inches or 36 acre-feet per square mile. 2/

Outside of the Tucumcari Project, and possibly the proposed Logan Project there appear to be few opportunities for stable irrigation by the use of surface water originating within that part of the Canadian Basin shown on Map 1. The large amount of water which formerly flowed in the Canadian River through Quay County is now captured in the multiple-purpose Conchas Reservoir, about 35 miles northwest of Tucumcari. Except in years of exceptional run-off such as 1941, there will be no natural flow into Quay County from the area above Conchas Dam and the stored water is appropriated for irrigation of the 45,000 acres in the Tucumcari Project.

It is evident from Table 1 that a few of the tributaries in this area should yield considerable surface water but that the run-off will occur in flash floods which will be too erratic in occurrence and duration to be useful in dependable irrigation. Storage is needed for utilization of the surface water and there are few satisfactory storage sites on these streams.

1/ Ibid P. 834
2/ Ibid P. 852

The flood water which frequently flows in the major tributaries such as Plaza Larga and Pajarito Creeks might be beneficially diverted on both native and cultivated hay meadows and for the flood irrigation of grain sorghums and other feed crops. Although the erratic nature of these floods precludes any dependence on them for stable farming, such flood irrigation might be a valuable adjunct to other enterprises such as livestock production. The major obstacle to utilization of these discharges for flood irrigation is the expense of diversion. No instances are known where land is suitable for flood irrigation except along rather wide and deep channels, where diversion structures would be extremely expensive. Unless particularly favorable locations are found, it appears that even flood irrigation by direct diversion is not economically feasible in Quay County. This conclusion does not apply to water-spreading measures in arroyos and other normally dry water courses. They are not generally classified as irrigation because the primary object is the maintaining of a protective vegetative cover which will prevent erosion, reduce flood peaks and minimize the movement of silt into the larger streams. Numerous opportunities for such water-spreading measures are found in this basin, although the uncertain character of the flood flows precludes the expenditure of large unit costs such as might be justified where more dependable water supplies are available.

Storage Possibilities

The first three sites listed in Table 4 have been filed on by the Bureau of Reclamation for inclusion in the plans for the Tucumcari Project.

The proposed reservoir on Plaza Larga Creek would capture flood water and furnish a supplemental supply for project lands below that site. The mean annual water yield from the 350 square miles above that site is estimated to be 12,625 acre-feet which, after deducting evaporation losses, would furnish an average of about 10,000 acre-feet for irrigation. 1/ The Revuelto Site, No. 3, was recently proposed to catch flood waters which now escape unused from the Canadian Basin. Data and plans are not yet complete but this water might irrigate lands within an extension of the presently defined Tucumcari Project. Site 2, on Blanca Creek, is proposed as an off-channel storage for water to be diverted through a canal from Pajarito Creek in Section 12, T. 10 N., R. 28 E. See page 28 for further details.

Site 4, designated in Table 4 as the Tucumcari-Pajarito Site, was suggested in House Document No. 308 as a regulating reservoir in the main canal system for the Tucumcari Project, as well as to capture the flood discharge of Pajarito Creek. The Bureau of Reclamation has not filed on this site and has no present plans for its development.

Site 5, on upper Pajarito Creek, is part of a privately conceived project which proposed the irrigation of about 1,000 acres near Newkirk in Guadalupe County. This project will be discussed independently under the title of the Newkirk Project. Since the other known reservoir sites would benefit only lands within the Tucumcari Project, it appears that there will be no opportunity for irrigation by use of surface water in Quay County except under that project. 2/

1/ House Document No. 308, P. 852

2/ If the proposed Logan Project now under investigation by the Bureau of Reclamation proves feasible, most of the irrigated land under that project will be in Quay County at the mouth of Ute Creek.

In the event that any large storage reservoirs are built in Quay County, the Agricultural Planning Committees might well give attention to securing the maximum advantages from them in the way of recreation and wildlife uses. The Fish and Wildlife Service should be consulted in this regard, but the following points are worth consideration if not incompatible with the primary purpose of the reservoir.

(1) Each reservoir should be studied in its planning stage with a view to acquiring sufficient land above the high water line to secure to the public all practical recreation and wildlife benefits.

(2) Construction plans might provide low dikes which would impound conservation pools in the upper end of reservoirs, making possible the maintainance of aquatic plants needed to sustain migratory wildlife when the general water level has fallen too low.

(3) By placing the outlet high enough, draining of the lake and destruction of fish and wildlife can be prevented.

(4) The reservoir should be operated to avoid too rapid drawdown of the water level which often causes serious erosion of the lake bottom and consequent damage to aquatic life.

Table 4

RESERVOIR SITES IN QUAY COUNTY

Site No.	Name of Site 1/	Stream	Location Section	Location Township	Range	Storage Capacity (Acre-feet)	Drainage Area 2/ (Square Miles)	Estimated Cost
1 3/	Plaza Larga	Plaza Larga Creek	NE¼ 21	10 N.	31 E.	40,000	350	Unknown
2 3/	Blanca	Blanca Creek 6/	17	10 N.	29 E.	12,000	6/	Unknown
3 3/	Revuelto	Revuelto (Tucumcari) Creek 7/	NE¼ 26	13 N.	33 E.	Unknown	780	Unknown
4 4/	Tucumcari-Pajarito	Pajarito Creek	15	11 N.	29 E.	16,000	350	$1,031,500
5 5/	Newkirk-Pajarito	Pajarito Creek	4	9 N.	25 E.	2,650	50	72,727

1/ Names and numbers of sites are assigned arbitrarily for discussion and location on Map 3.

2/ Drainage areas metered from base maps of the Highway Planning Survey, except for Site No. 4.

3/ Information from Bureau of Reclamation.

4/ Information from House Document No. 308, Corps of Engineers, U. S. Army, P. 852.

5/ Information from applications of the Pajarito Water Users Association for water right and for a PWA loan. Site is in Guadalupe County but is on headwaters of stream which flows through Quay County.

6/ This reservoir is proposed to store water to be diverted through a canal from Pajarito Creek in southwest quarter of Sec. 12, T. 10 N., R. 26 E. There would be 115 square miles of catchment area above the diversion and 20 above the reservoir site.

7/ The filing calls this stream Revuelto Creek but standard maps give that name only to a tributary and call the main stream Tucumcari Creek.

Areal Geology and Ground Water

Sedimentary deposits that range in age from Triassic to Recent form the land surface of Quay County, New Mexico. No igneous rocks outcrop, nor does the subsurface presence of these rocks materially affect the occurrence or movement of ground water in the county.

The depths of water shown on Map 2 indicate the average drilling depths in the different subareas except in the area where the Triassic rocks occupy the land surface. In the area of Triassic outcrop only the average depths of the existing wells is indicated. It is almost impossible to forcast with any degree of accuracy at what depth water will be encountered by the drill in this formation.

Ground-water supplies for irrigation purposes are recoverable in sufficient quantities and within economic pumping limits only in the area known as the House shallow water basin. 1/ Elsewhere in the county where shallow ground-water supplies are available, especially along the alluvial channels of the major streams, the permeability is usually too low and the water-bearing formation is usually too thin for these sediments to yield adequate water supplies for irrigation purposes.

A brief description of the lithological characteristics and the ground-water supply of the formations, in their order of deposition, follows:

Triassic System: The Dockum group represents the sediments of Triassic age in this county. These deposits are approximately 800 feet

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1/ See Water Facilities Area Plan for the Quay-Curry Area.

thick and consist primarily of red to light brown interbedded shales and sandstones. A thick persistant sandstone (the Santa Rosa) lies near the base of the formation. The great thickness of this group precludes the possibility of obtaining stock and farmstead water supplies from older deposits which underlie the Dockum group.

The Triassic deposits do not yield large supplies of water and their water is often of unsatisfactory quality. Ground water occurs only in discontinuous sand lenses and in joints and fissures of this formation. Owing to its erratic occurrence, the presence of under-ground water in the Dockum group, and its suitability for stock and domestic consumption can be determined only by a drill test.

Jurassic System: The Wingate sandstone is primarily a light-gray, massive, cross-bedded, friable sandstone.

The Wingate sandstone is a fairly reliable source of potable water. A few wells near the outcrop area are less than 550 feet in depth. This area, however, is very small in extent.

The Morrison formation was formerly considered to be Lower Cretaceous in age. However, it is now classified by the U. S. Geological Survey as Upper Jurassic. It consists of a greenish-gray massive shale with interbedded sand lenses and is not a good aquifer. Little reliance can be placed on it to furnish stock and farmstead water in this county.

Cretaceous System: The Purgatoire formation which consists of sandstones and shales is the only representative of the Lower Cretaceous

age known to be present in this county. This formation is overlain by the Dakota sandstone of Upper Cretaceous age.

The Dakota formation outcrops in the northwestern portion of the county and caps small outlying erosional remnants. It probably underlies the Ogallala formation in the southern and extreme northern portions of the county.

Neither the Purgatoire nor the Dakota formations are good aquifers in their outcrop area. Where present below the surface they are overlain by the Ogallala formation which is an excellent source of ground water. Hence, both of these Cretaceous formations are insignificant to the ground water resources of the county.

Tertiary System: The Ogallala formation of Pliocene-Miocene age forms the land surface of the High Plains portion of the county. 1/ The Ogallala formation is composed of a heterogeneous mixture of calcareous grit, sands, sandy clays, clays and gravels.

The Ogallala formation is the principal water-bearing deposit in the county. An abundant supply of water of suitable quality for all stock and farmstead needs is available from the water-bearing column at the base of this formation. Except in the area commonly known as the House shallow-water area, the depth to the water table prohibits the use of this water for irrigation purposes.

Quaternary System: Along practically all the stream valleys alluvial deposits of sand, silt, clay and gravel occur. The thickness of these deposits ranges from zero to a maximum of about 50 feet. Only

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1/ This was the Quay-Curry Area for which a Water Facilities area plan was published in August 1939.

along the major stream courses are these deposits of sufficient thickness to be considered good aquifers. Along these major stream courses the alluvium is capable of yielding adequate quantities of suitable water that meets all stock and farmstead needs at rather shallow depths. However, these sediments do not yield water in sufficient quantities for irrigation purposes.

A small unmapped sand-dune area that was derived mainly by wind action on the Ogallala formation, exists in the vicinity of Obar. The perched water table of this dune-sand area is capable of yielding adequate supplies of good water to meet domestic and livestock requirements but yields would be too small for irrigation purposes.

STRATIGRAPHIC SEQUENCE OF EXPOSED FORMATIONS
QUAY COUNTY, NEW MEXICO

	System	Series & Group	Formation	Character of rocks	Water Supply
CENOZOIC	Quaternary	Recent	Dune Sands	Sand mainly in dunes due to wind action.	Capable of yielding adequate supplies of suitable water for stock and domestic use.
			Alluvium	Loam, sand, gravel, and clay in valleys, talus on slopes.	Furnishes potable water in the valleys of the major streams.
	Tertiary	Pliocene Miocene	Ogallala	Calcareous grit, sands, clays, gravels and sandy clays.	Yields large supply of potable water.
MESOZOIC	Cretaceous	Upper Cretaceous	Dakota	Gray to buff indurated sandstones with interbedded shales.	In Quay County this sandstone is generally so highly indurated that it is practically impervious. Only meager supplies are obtained from this formation.
		Lower Cretaceous	Purgatoire	Sandstone and shale.	The outcrop area is small, and very little water occurs in the sand sections of this formation.
	Jurassic		Morrison	Greenish-gray massive shale with interbedded sand lenses.	Yields only meager supplies of water usually too highly mineralized for consumptive use.
			Wingate sandstone	Light-gray massive sandstone.	Yields large supplies of potable water.
	Triassic	Dockum Group		Red to brown shales and sandstones. Santa Rosa sandstone at base.	Ground-water supplies are erratic in occurrence and limited in quantity, and often unsuitable for consumptive use.

PRESENT USE OF THE AREA

Present Water Use

There is no irrigation of consequence at this time in the Canadian Basin in Quay County, from either surface or ground water. The Arch Hurley Conservancy District, elsewhere referred to as the Tucumcari Project, has been organized to irrigate some 45,000 acres of land by use of Canadian River water impounded in Conchas Reservoir. The main canal and distribution system are now under construction by the Bureau of Reclamation.

The lands to be irrigated are now range, and individual ownerships vary in size from a few acres to 6,000 acres. It is understood that in order to receive water, farms must not exceed 160 acres for a single person or 320 acres for the head of a family. Excess lands may be sold by present owners, but the Government can recapture one-half of the money received above the appraised values without irrigation benefits, which have been fixed by the Secretary of the Interior at $10 to $30 per acre. The Bureau of Reclamation has estimated that the project area will provide homes for 500 to 600 farm families. The estimated cost of the canal and distribution system is $8,155,000 of $2,500,000 was a grant from PWA funds, leaving a net obligation of $5,655,000 or $126 per acre, to be repaid to the Federal Government in 40 equal annual installments without interest. 1/

1/ Press Release concerning the Tucumcari Project, Bureau of Reclamation, January 15, 1940.

A preliminary classification of the irrigable project lands in 1937 gave criteria which are briefed as follows: Class 1 lands are free-working soils with slight amounts of neutral salts but free of black alkali; with soil depths in excess of two feet except where underlain by shale or [illegible] rock, where they must be over four feet; slopes must not exceed three per cent and must be smooth enough that no heavy grading will be required for leveling for irrigation; and artificial drainage does not appear necessary but can be accomplished readily if required. Lands in Class 2 must be 18 inches deep, or 30 inches where underlain by rock; total soluble salts must not exceed 0.5 per cent and the hydrogen ion concentration must be above 8.6; slopes may be as high as eight per cent, if smooth; and drainage may be necessary but can be accomplished at a reasonable cost. Areas were given as:

Class 1 - 16,506 acres - 35 per cent

Class 2 - 30,828 acres - 65 per cent [1]

No information is available as to plans for selecting prospective settlers for this project, for financing the subjugation and development of their farms for irrigation or for instruction and supervision in proper irrigation practices. It has been suggested that the Department of Agriculture take an active part in these phases of the project development, similar to its part in the Wheeler-Case Program, and there are reports that the Farm Security Administration is planning to do so.

Some parts of the basin are well supplied with farmstead wells, but there are several areas in which wells have not encountered ground

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[1] Reimig and Mutch, Pages 38 and 39.

water at reasonable depths or the quality has been unfit for domestic use. In those areas the securing of farmstead-water supplies is a major problem. Stock tanks have been fairly well distributed throughout the area under the AAA Program, but some additional stock-water facilities are needed to secure more uniform grazing and maximum utilization of the range. In many places the normally dry drainage channels have cut deeply enough to intercept the water table for short distances and these pools also supply livestock needs. Few stock tanks which impound surface run-off are dependable through long dry periods and there is a great need for permanent livestock water supplies in the areas that lack adequate farmstead wells.

The C. R. I. & P. Railroad has a License to Appropriate 20,000 gallons of surface water per day from Revuelto Creek, a minor tributary of Tucumcari Creek. It is locally reported that this right has not been exercised for several years. The railroad now buys water from the City of Tucumcari.

The City of Tucumcari derived its municipal water supply from five wells in 1940, but figures on the annual pumpage are not available. Other towns in the area, such as San Jon and Logan, have municipal wells which supply their needs. So far as is known these are the only important municipal, industrial or recreational uses of surface or ground water in this area.

Plans are now under consideration for the use of surface water in the municipal system of the City of Tucumcari. It is proposed to divert from Pajarito Creek in Section 12, T. 10 N., R. 26 E., through a canal

into a 12,000 acre-feet reservoir to be formed by a dam on Blanco Creek in Section 17, T. 10 N., R. 29 E. Water would then be conveyed from this storage as needed through another canal to the City Water Works, where a treating plant would be constructed. Construction would be by the Bureau of Reclamation, financed by the City of Tucumcari. The probable future municipal demand, including water purchased from the City for railroad supply, has been estimated at about 4,000 acre-feet a year. This diversion and use is the reason for Filing No. 2428, listed in Table 6.

Status of Water Rights

A search of the State Engineer's records disclosed the water rights of the Canadian River Basin in Quay County which are listed in Table 6. One License to Appropriate water has been issued for railroad water-supply purposes. Several years ago the State of New Mexico reserved 1,000,000 acre-feet for storage in the Conchas Reservoir on the Canadian River in San Miguel County, to be used for irrigation of the Tucumcari Project. 1/

Since December 5, 1958, the Bureau of Reclamation has filed reservations of water with the State Engineer for 300,000 acre-feet annually from the Canadian River and for all unappropriated waters of Revuelto, Plaza Larga and Pajarito Creeks. Copies of these follow Table 6. The applications for the Logan - Ute Conservancy District 2/ and for the Pajarito Water Users Association 3/ are in the first stages and issuance of the final license will be conditioned on construction of the necessary works and application of the water to beneficial use (actual irrigation)

1/ Keimig and Mutch, P. 30
2/ Elsewhere referred to as the Logan Project
3/ Elsewhere referred to as the Newkirk Project

on the project lands. The water supply for the Logan Project will be derived from Ute Creek, which is not included in the Canadian River Basin in Quay County as treated in this report, but the project is mentioned here because most of the land proposed for irrigation would lie within Quay County on the east side of Ute Creek near its mouth. The Newkirk Project is in Guadalupe County, but is discussed fully in this report because the entire project, including the water supply, is located in the headwaters of Pajarito Creek which flows for most of its length through Quay County.

Table 6

WATER RIGHTS AND APPLICATIONS - CANADIAN BASIN IN QUAY COUNTY

State Engineer's File No.	Source of Water Supply	Date of Priority	Storage Reservoir			Water Licensed or Applied for (Acre-feet)	Storage Capacity (Acre-feet)	Irrigated Land			
			Sec.	Twp.	Range			Acres	Location		
									Sec.	Twp.	Rang
1497 8/	Revuelto Creek	Aug. 19, 1922	36	NE¼ of NW¼ 11 N.	32 E.	20,000 gal. per day	367.85	Railroad Water Supply			
2270 1/	Pajarito Creek	June 29, 1938	4	9 N.	25 E. 2/	5,000	2,650	1,000 3/	14,15,22,23, 24,26,27	10 N.	25 E
2305 5/	Canadian River	Dec. 5, 1938	Conchas Reservoir			300,000	7/	Tucumcari Project			
2360 4/	Ute Creek	Sept. 6, 1939	36	17 N.	30 E.	120,000	60,000	30,000	--- ---	13 N. 14 N.	[illegible] 35
2425 5/	Plaza Larga Creek	June 12, 1941	21	NE¼ 10 N.	31 E.	All unappropriated waters	6/	Tucumcari Project			
2428 5/	Pajarito Creek	July 21, 1941	12	NE¼ 10 N.	26 E.	All unappropriated waters	6/	Tucumcari Project			
2443 9/	Revuelto Creek	Oct. 13, 1941	26	NE¼ 13 N.	33 E.	All unappropriated waters	6/	Tucumcari Project			

1/ Permit issued to the Pajarito Water Users Association, Newkirk, New Mexico. An extension of time was granted under Filing 2270 to January 1, 1942, for completion of construction.

2/ The application in the State Engineer's office does not apply for storage rights, but mentions only a diversion in the SE¼ of NE¼, Sec. 24, T. 10 N., R. 25 E. However, the project plans filed with an application for a PWA lo on September 29, 1938, included the storage reservoir listed herein.

3/ The application submitted for the PWA loan states an intention to irrigate 2,090 acres, but officials of the association have verbally stated that only about 1,000 acres were proposed for irrigation.

4/ Permit issued to Logan-Ute Conservancy District, Logan, New Mexico. Preliminary plans are now being prepared by the Bureau of Reclamation.

5/ Reservations by the Bureau of Reclamation.

6/ Storage capacity of proposed reservoirs not given in reservation.

7/ Constructed with storage capacity of 600,000 acre feet, to be apportioned between flood control and irrigation.

8/ It is locally reported that this right has not been exercised for several years. The railroad now buys water from the City of Tucumcari.

9/ Reservation by the Bureau of Reclamation. All standard maps show Revuelto Creek as a tributary of Tucumcari Creek. However, this filing indicates that both names are applied to the major streams.

Pursuant to Section 151-152, New Mexico Statutes, 1929 Compilation, the Bureau of Reclamation notified the State Engineer of New Mexico that the United States intends to utilize the following described waters. It was therefore requested that these waters be withheld from further appropriation and that the rights and interests of the United States in the premises be otherwise protected as contemplated by this statute.

Filing No. 2305 December 5, 1938

"An annual volume of water of three-hundred-thousand (300,000) acre feet for immediate diversion or for storage and subsequent diversion, at rates not exceeding ten thousand (10,000) cubic feet per second, to be diverted from the South Canadian River and its tributaries at the Conchas Dam, or stored in the reservoir formed thereby, now being constructed by the United States in San Miguel County, New Mexico."

Filing No. 2425 June 12, 1941

"All the unappropriated waters of Plaza Larga Creek, (a tributary of the South Canadian River) and of the tributaries of said Plaza Larga Creek, for immediate diversion or for storage and subsequent diversion, to be diverted from said Plaza Larga Creek at a dam which would be constructed at a point in the northeast quarter of Section 21, Township 10 N., Range 31 East, N. M. P. M., or to be stored in the reservoir formed thereby, or to be diverted from or stored in said Plaza Larga Creek by means of a dam or dams at such other point or points on the said Plaza Larga Creek as may be determined to be feasible, such storage or

diversion works, or both, and the water supply provided thereby, to be used in connection with the Tucumcari Federal Reclamation Project, now being constructed or to be constructed by the United States in Guadalupe, San Miguel and Quay Counties, New Mexico".

Filing No. 2409 July 21, 1941

"All of the unappropriated waters of Pajarito Creek, a tributary of the South Canadian River, and of its tributaries, for immediate diversion or for storage and subsequent diversion, to be diverted from the said Pajarito Creek at a diversion dam which would be constructed at a point in the southwest quarter of Section 12, Township 10 North, Range 26 East, N. M. P. M., or to be stored in the reservoir formed by said dam or to be diverted or stored, or both, at such other points on the Pajarito Creek as may be determined to be feasible, said water supply to constitute a part of the water supply of the Tucumcari Federal Reclamation Project, now being constructed by the United States in Guadalupe, San Miguel and Quay Counties, New Mexico, and the works for the storage, diversion and carriage of said water supply to constitute a part of said Tucumcari Project."

Filing No. 2443 October 15, 1941

"All of the unappropriated waters of Revuelto Creek (a tributary of the South Canadian River) and of the tributaries of said Revuelto Creek, for immediate diversion or for storage and

subsequent diversion, to be diverted from the said Revuelto Creek at a dam which would be constructed at a point in the northeast quarter of Section 26, Township 13 North, Range 33 East, N. M. P. M., or to be stored in said Revuelto Creek by means of a dam or dams at such other point or points on the said Revuelto Creek as may be determined to be feasible, such storage or diversion works or both and the water supply provided thereby, to be used in connection with the Tucumcari Federal Reclamation Project now being constructed or to be constructed by the United States in Guadalupe, San Miguel and Quay Counties, New Mexico."

Proposed Newkirk Irrigation Project [1]

The State Engineer has issued Permit No. 2270 with priority of June 29, 1938 to the Pajarito Waters Association for the diversion of 5,000 acre-feet annually from upper Pajarito Creek for the irrigation of lands within the following subdivisions near Newkirk, New Mexico:

W½	Section	14	
E½ E½ SW¼	"	15	
All of	"	22	All in Township 10
All of	"	23	North, Range 25 East.
S½	"	24	
N½	"	26	
N½ and SE¼	"	27	

On August 21, 1940, the State granted an extension of time under this permit to January 1, 1942 for completion of construction and to January 1, 1943 for application of the water to beneficial use.

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[1] This name is arbitrarily used in connection with this project to avoid confusion with the other suggested reservoirs on Pajarito Creek for the Tucumcari Project.

Neither the Application nor the Permit to Construct mention storage, but an application was made by this association to the Public Works Administration on September 29, 1938, for the construction of a reservoir on upper Pajarito Creek. 1/ The proposed storage capacity was 2,650 acre-feet behind an earth dam with a maximum height of 55 feet and a crest length of 500 feet. The engineers estimated the drainage area to be roughly 50 square miles. The land proposed for irrigation was given as about 2,090 acres divided among 37 owners, the units varying in size from garden plots to one of a half-section. Mr. De Baca stated that a few of the landowners are experienced farmers, many of them being stockmen. Powell and Goldenberg, Consulting Engineers, in this application estimated the total cost as $72,727 divided as follows:

Storage dam and appurtenant works	$39,250
Diversion dam	10,000
Canal system	15,000
Legal and engineering fees, interest during construction, contingent, etc.	8,477
Total estimated project cost	$72,727

It was proposed to repay a loan of $49,000 over a 40-year period, the remainder of the cost to be provided by a grant. The application provided for uniform annual repayments of $2,852 which, with an allowance of $100 for operation and maintenance, were to be raised by annual assessments of $2.03 per irrigated acre. 2/

Mr. De Baca has stated that they contemplated the irrigation of around 1,000 acres which is smaller than indicated by either of the above

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1/ From copy of the application in possession of President Luis E. De Baca, Newkirk.

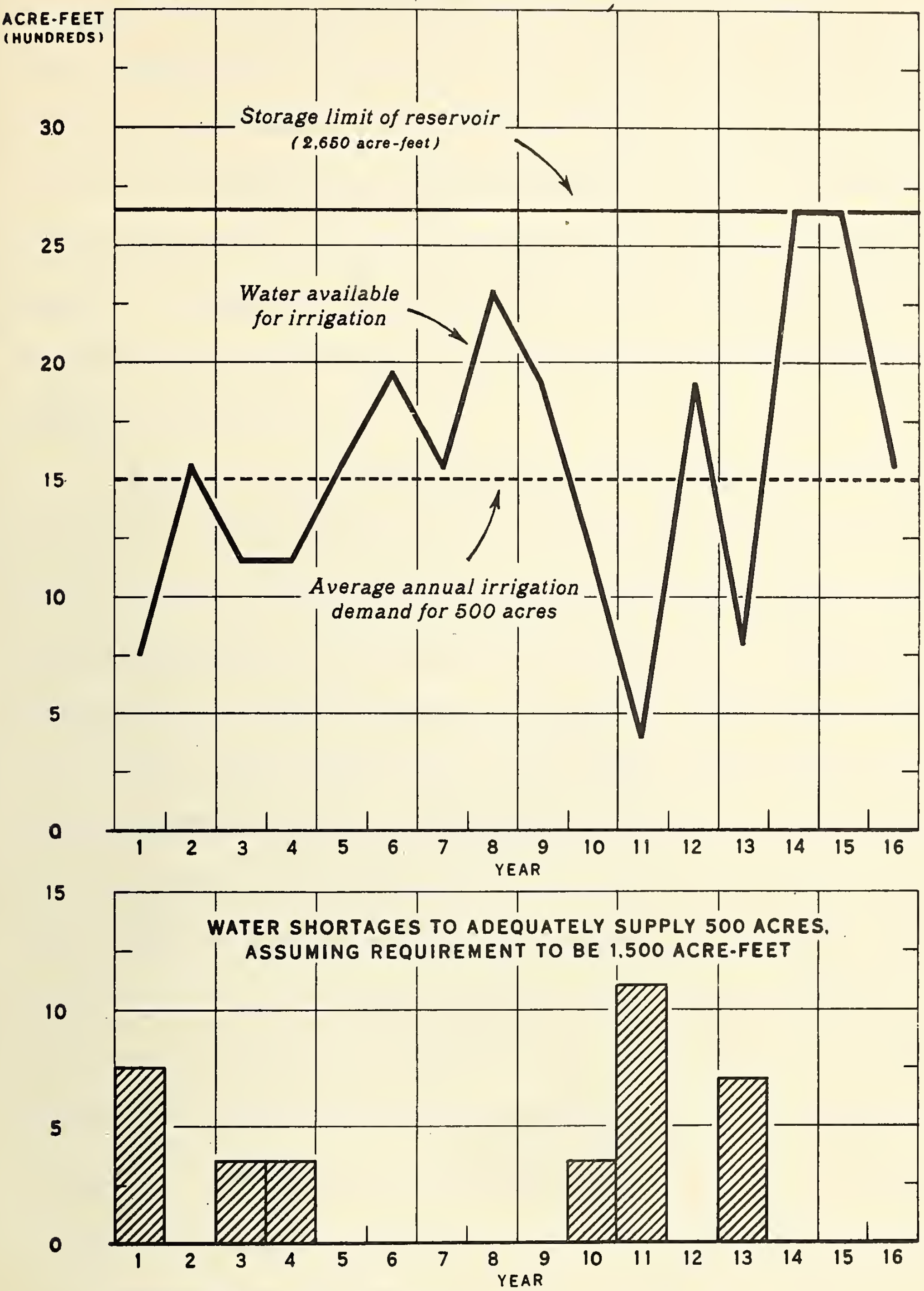
2/ This assessment indicates a total of 1,454 acres.

filings. The irrigable area appears to be further limited by the available water supply adequate for 500 acres or less. (See Chart 1) The original estimate of $72,727 would amount to $145 for each of the 500 irrigated acres, which is far more than could be justified by the returns on other irrigated projects in the Southwest. Since that time, 1938, material and labor costs have risen until the present cost would undoubtedly be considerably greater.

Metering of the catchment area above Site 4 on base maps of the New Mexico Highway Planning Surveys confirms the figure of 50 square miles given in the application to the Public Works Administration. Unfortunately there are no long records of run-off from small drainage basins in this vicinity, to guide an estimate of water supply. Drainage from 575 square miles of the Tierra Blanca Creek watershed above Buffalo Lake near Canyon, Texas, amounted to 7.6 acre-feet per square mile in 1938-1939 and 0.8 in 1939-1940. Undoubtedly this very low average will be raised considerably when figures on the 1941 floods are available. Observed flood flows from 114 square miles of the Perico Creek watershed above Clayton, New Mexico, averaged about 32 acre-feet per square mile over the five years from 1935 to 1939. Both of these records are too short for quantitative conclusions. Reference to the foregoing discussion of Surface Water Supply indicates that a mean annual run-off of 36 acre-feet per square mile resulted from a precipitation of about 16 inches, averaged over the entire Canadian Basin above Conchas Dam. There are no weather records within this 50 square miles above Site 4, but precipitation at Cuervo, just outside and

HYPOTHETICAL ANNUAL PERFORMANCE OF PROPOSED NEWKIRK-PAJARITO RESERVOIR

SITE 4-UPPER PAJARITO CREEK, QUAY COUNTY, NEW MEXICO



ASSUMPTIONS: *IRRIGATED AREA—500 ACRES.*
ADEQUATE WATER SUPPLY—3 ACRE-FEET PER ACRE AT RESERVOIR OUTLET.
MEAN ANNUAL WATER YIELD OF DRAINAGE AREA—1,800 ACRE-FEET.
ORDINARY LOSSES OF WATER STORES IN RESERVOIR.

U. S. DEPARTMENT OF AGRICULTURE NEG. 39903 BUREAU OF AGRICULTURAL ECONOMICS

on the west, has averaged 13.26 inches for the 31 years prior to 1940. At Santa Rosa, the next station to the west, the mean annual precipitation for 40 years was 14.19 inches. This figure is a little below the mean for the larger watershed, but a small part of the catchment basin above Site 4 is on the High Plains, several hundred feet higher in elevation than the two stations cited, and where the rainfall is probably somewhat greater. From this evidence it can reasonably be deduced that this small upper Pajarito basin may produce a mean annual yield of 36 acre-feet per square mile or 1,800 acre-feet.

Averages are usually misleading when applied to water supply for irrigation, particularly in small drainage basins where the stream discharge depends largely on flash floods and is even more erratic than in larger watersheds. If the irrigated area were well balanced with the average water yield, the excess in years of above-average run-off would be of little value while crops would suffer in years when the water yield was materially below the irrigation requirements. The proposed 2,550 acre-feet reservoir would overcome these discrepancies to some extent but could not provide all of the deficits in dry years. Inasmuch as there is no long-time register of stream discharge which can be applied to Pajarito Creek, the performance of the Canadian River at Logan was studied. The hypothetical reservoir performance shown by Chart 1 is based upon that record with provision for ordinary reservoir losses. The irregularities of the hydrograph of Pajarito Creek can be expected to be more pronounced than those of the Canadian River, but on the other hand this 16-year period

of measurement, 1922 to 1939, contained an abnormally large number of years of low discharge. While this sequence of wet and dry years cannot be expected to recur in the same order, this chart gives a good picture of the water supply hazards which would confront the Newkirk Project. Even with an irrigated area of only 500 acres and the reservoir of 2,650 acre-feet shown in Table 7, in only 10, or 63 per cent, of the 16 years of record, would sufficient water have been available, while in four years the water supply would have been adequate for only 300 acres or less.

Table 7

STORAGE CAPACITY - NEWKIRK-PAJARITO RESERVOIR [1]

Depth of Water (feet)	Surface Area (acres)	Storage Capacity Increment (acre-feet)	Storage Capacity Total (acre-feet)
0	0.4		
10	5.6	30	30
20	15.4	105	135
30	42.3	289	424
40	88.2	653	1,077
50	225.3	1,567	2,644

[1] From surveys made by the Works Project Administration.

Soils [2]

"The soils are, in the main, heavy red clay soils derived from Triassic red beds. Water will be taken only slowly, and tilth will be

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[2] From reconnaissance report by Burnell G. West,
Junior Soils Technician, SCS, December 21, 1940.

difficult to maintain. The subsoils are hard and compact and are generally highly dispersed. Proper drainage in soils of this type would be very difficult and would probably result in a water-logged condition of the soils in at least a part of the area. There are slight amounts of salts present in all the soils. If salt-bearing water is used for irrigation, the alkali condition would be aggravated and, due to the poor internal drainage of these soils, would render a large portion of the area unproductive. There are several slick spots, blow-out spots and small areas of very active sheet erosion, many of which show moderate accumulations of salts. It is believed that the size and number of these would be increased under cultivation. There are several deep, actively cutting gullies in the area at the present time. A special problem would arise here, to keep the gullies from widening, and fingers and head cuts from eating back into the farm land, if this area is brought under cultivation and irrigation."

RECOMMENDATIONS

In addition to the following recommendations, reference should be made to the foregoing discussion of existing conditions to insure the consideration of all pertinent factors. There appears to be no opportunity for irrigation from the Canadian River or its tributaries except in the Tucumcari Project now being constructed by the Bureau of Reclamation or in the proposed Logan-Ute Creek Project under investigation by the same agency. However, if any favorable locations are found which would permit direct diversion of flood water for the flood irrigation of hay or feed crops, these should be carefully investigated by the operations agencies. The considerations mentioned below will govern such projects. The crops must be limited to those which are adapted to a water supply highly erratic in occurrence and amount of the returns from flood irrigation should not be the sole dependence for livelihood. In addition, there may be opportunities for water-spreading measures in arroyos and other normally dry water courses. Their primary object will be the maintaining of a protective vegetative cover to prevent erosion, reduce flood peaks and minimize the movement of silt into the larger streams. Owing to the uncertain character of the flood flows which will be produced from these comparatively small drainage areas, justifiable unit-costs for such water-spreading measures will be much lower than where the water supplies are more dependable.

Development of the proposed Newkirk Project does not appear feasible because: (1) the water supply probably would be inadequate for the

dependable irrigation of even 500 acres, (2) the soils do not seem to be adapted to long-continued irrigation; (3) the project cost, estimated in 1938, would be $145 per acre for an irrigated area of 500 acres; and (4) the project has no permit to construct a reservoir or to store water, but only to divert water from Pajarito Creek.

It is reported that there are a few springs in this basin whose discharge can be used for irrigation. None has been inspected in connection with this study and so far as is known these springs are too small to serve a family-size irrigated farm and too scattered to be combined for that purpose. However, they might suffice for the irrigation of a few acres of garden and supplemental feed crops and may become valuable adjuncts to the livestock enterprise where they occur. Where springs occur under favorable conditions and irrigation proves feasible, it is recommended that suitable facilities be installed for their use.

The following conditions should be observed in this connection:

(1) The beneficiary must secure a water right from the State or take the necessary steps to perfect a water right for which he may have applied earlier.

(2) The discharge should be dependable throughout the irrigation season and sufficient to enable proper irrigation. Where springs are the source of supply, construction of a small regulating reservoir to store the water over night and build up an adequate irrigating head will usually greatly increase the irrigation benefits.

(3) The soils should be thoroughly investigated by soils technicians and their suitability determined for long-continued irrigation with the particular quality of water which is available.

(4) In all cases the water should be analysed and its suitability determined for long-continued irrigation of the land on which it is to be used before detailed plans are made.

(5) The acreage to be irrigated and the cropping system should be adapted to the water supply so as to insure adequate irrigation for optimum crop production. Estimated irrigation requirements under efficient methods are discussed in a foregoing section. These requirements are averages; alfalfa will probably require twice as much water as grain sorghums. Irrigation requirements will vary somewhat with soil conditions and precipitation but care should be exercised not to develop larger acreages than the water supply can be expected to serve adequately.

(6) Regardless of repayment ability the economic feasibility of each project should be carefully analyzed. This analysis should be done by balancing the annual cost of the installation, averaged over its prospective life, against the average annual value of the crops which can be expected. This worth should not be based on average market prices, but upon the value to the operator in that particular location.

(7) No instances are recorded where the discharge of springs would be adequate for the irrigation of a large enough tract of land to furnish a dependable livelihood. The utilization of springs and of flood flows in the larger tributaries, if at all feasible, appears to fit best into supplemental production for livestock enterprises. Outside of large projects with a dependable water supply, farmers should not be encouraged to depend for their entire livelihood upon irrigation for the production of truck and other high-value crops.

No locations are known where ground water can be pumped in quantities sufficient for irrigation and on the basis of present knowledge no facilities are recommended for such irrigation. This does not apply to the use of wells for irrigation of gardens, which should be encouraged as much as possible.

Assuming the quality of the water to be the same, the order of preference as to source of supply for farmstead and stock water is usually (1) springs, (2) wells, and (3) surface reservoirs or "stock tanks". Where springs are convenient, they can often be developed into a satisfactory supply, with small storage facilities if needed, at less cost than the other two sources. Wells are preferred to surface reservoirs for farmstead water, except where cost would be prohibitive, on account of the necessity for absolute sanitation where domestic use is concerned. For stock-watering purposes, the major factor in determining the feasibility of wells will be the depth to water.

It is recommended that farmstead water facilities be installed wherever the need exists and where the farm enterprise is in harmony with the proved economy and can reasonably be expected to be permanent. Their installation should be accompanied by a garden program. Where possible these facilities should be of a group nature so that the money expended will benefit as many families as possible. Care should be observed to insure that the families to be benefited will be all, or nearly all, true farm families to avoid encroachment on the field of municipal water supply. Particular attention should be paid to sanitary features of all facilities which will be used for domestic

purposes. In all cases the water should be analyzed and its suitability for domestic or stock use determined as early in the detailed planning as possible. As indicated on Map 2, it may be impossible to obtain farmstead wells with satisfactory water at reasonable depths in some parts of Quay County. In some cases a few group farmstead wells strategically located would greatly reduce the water haulage. If wells are entirely impracticable, favorable sites should be looked for where surface water could be stored at reasonable cost and in sufficient depth to carry over prolonged droughts. With proper filtering equipment the water could be made satisfactory for domestic use. This has been done by the Farm Security Administration near Stanton, Martin County, Texas, and the facilities seem to be giving satisfactory service.

In some places small stock tanks may be useful to furnish a seasonal water supply and enable a better distribution of grazing. However, stock tanks which are intended to store surface water for a permanent supply, and constituting the only source of supply, should have an adequate catchment area and sufficient depth to provide a reserve for evaporation and seepage losses over a prolonged drought, as these losses are much more than the consumption by livestock. In general, the average annual cost of recovering ground water at depths of less than 200 feet by means of windmills is less than the cost of storing surface water in stock tanks affording the same dependability of supply. Map 2 presents the known data on the occurrence of and depth to ground water which, in most zones, will enable the calculation of comparative costs.

The number or location of stock water facilities which may be requested cannot be known without a detailed survey. Although not likely to occur, excessive development of stock tanks in the headwaters of Plaza Larga and Pajarito Creeks, above the contemplated diversions listed in Table 4, might conceivably result in the retention of so much surface water that irrigation rights under those permits would suffer. Therefore, individual stock tanks should not exceed 10 acre-feet in capacity and the total storage constructed under authority of this proposal in the watersheds above these proposed sites should not exceed 400 acre-feet. Since surface water originating in the remainder of this area is not put to beneficial use, the development of storage for this purpose will not affect any irrigation interest. The fencing of silt detention areas of 10 acres or more in the drainageways immediately above small reservoirs is recommended wherever possible. If grazing is permanently excluded from these protective areas, the natural vegetation will usually retard siltation of the reservoirs to a large extent. Incidentally, valuable cover would be provided for wildlife and the Fish and Wildlife Service will be glad to advise in this connection.

APPENDIX I

CLEARANCE OF THE WATER FACILITIES OPERATIONS GUIDANCE REPORT FOR THE CANADIAN BASIN IN QUAY COUNTY, NEW MEXICO

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UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics
Box #217
State College, New Mexico

January 21, 1942

Water Facilities Board
Washington, D. C.

Re: Water Facilities Operations Guidance Report, Canadian River Basin.

Gentlemen:

In accordance with the procedure followed in New Mexico by the State Agricultural Planning Committee, the Land Grant College-BAE Committee at a meeting at State College, January 21, 1942, considered the Water Facilities Operations Guidance Report for the Canadian River Basin. An excerpt from the minutes relative to this matter is as follows:

> "1. The committee considered the Water Facilities Area Plan for the Dry Cimarron River Watershed in Colfax and Union Counties, New Mexico, and the Operations Guidance Report for the Canadian River Basin in Quay County, New Mexico, and indicated approval for submission to the Water Facilities Board."

Very truly yours,

/s/

Ralph Charles
BAE Representative for New Mexico

cc: Messrs:
Bushrod W. Allin
M. M. Kelso
H. B. Elmendorf

Tucumcari, N. M.
Feb. 6, 1942

Mr. Harold B. Elmendorf
Regional Water Utilization Supervisor
Box 147
Mesilla Park, N. M.

Dear Mr. Elmendorf:

Your revised copy of the Water Facilities Report issued in August has been presented to the Quay County Agricultural Planning Committee on January 15, 1942 for its consideration. This report was not gone into page by page, but a summary of the article including the map was presented to the committee. It is the opinion of the committee that the report is a very fine article and we realize that it has taken considerable time to render such a report for this county. The Planning Committee certainly appreciate the work and recommendations that you have made.

I am glad to inform you that the report was well taken by the committee and that your recommendations were given considerable attention, and that they agree that the irrigation projects which you have recommended are possibly the only projects worth considering. However, we have made recommendations to the BAE Committee that a further report and study of the Ute Creek Project should have further consideration. Quite a number of the Planning Committee members are interested in this project and feel that there is possibly further development which would be a worthwhile practice if the findings of the Engineers' report meet with our expectations. Other than this remark, we unanimously adopt the report as submitted.

Yours very truly,

/s/

C. D. CLAMPITT, Chairman
QUAY COUNTY AGRICULTURAL PLANNING COMMITTEE

CDC:IM

UNITED STATES
DEPARTMENT OF AGRICULTURE
Soil Conservation Service

Amarillo, Texas
January 6, 1942

Mr. Harold B. Elmendorf
Regional Water Utilization Supervisor
Box 147
Mesilla Park, New Mexico

Dear Mr. Elmendorf:

As requested in your January 1 transmittal of the advance copy of Water Facilities Operations Guidance Report For The Canadian River Basin in Quay County, New Mexico, we have examined the revised draft and concur in the recommendations made.

Very truly yours,

/s/

H. H. Finnell
Regional Conservator

UNITED STATES DEPARTMENT OF AGRICULTURE
Farm Security Administration

Amarillo, Texas

Mr. Harold R. Elmendorf
Regional WF Supervisor
Bureau of Agri. Economics
Mesilla Park, New Mexico

SUBJECT: Water Facilities -
WF Report for Canadian
Basin in Quay County,
N.M. (Revised Draft)

REPLYING TO: HRE 1-1-42

Dear Mr. Elmendorf:

We have reviewed the revised draft of the water facilities report for the Canadian Basin in Quay County, New Mexico, and believe that the recommendations contained therein will obtain the objectives of the Water Facilities Program.

Sincerely yours,

/s/

Jesse B. Gilmer
Acting Regional Director

APPENDIX II

MAPS

Contents

	Map
Areal Geology	1
Availability of Ground Water.	2
Surface Water Facilities.	3

QUAY COUNTY, NEW MEXICO

AREAL GEOLOGY

EXPLANATION

SYMBOL	AGE	FORMATION
▨		

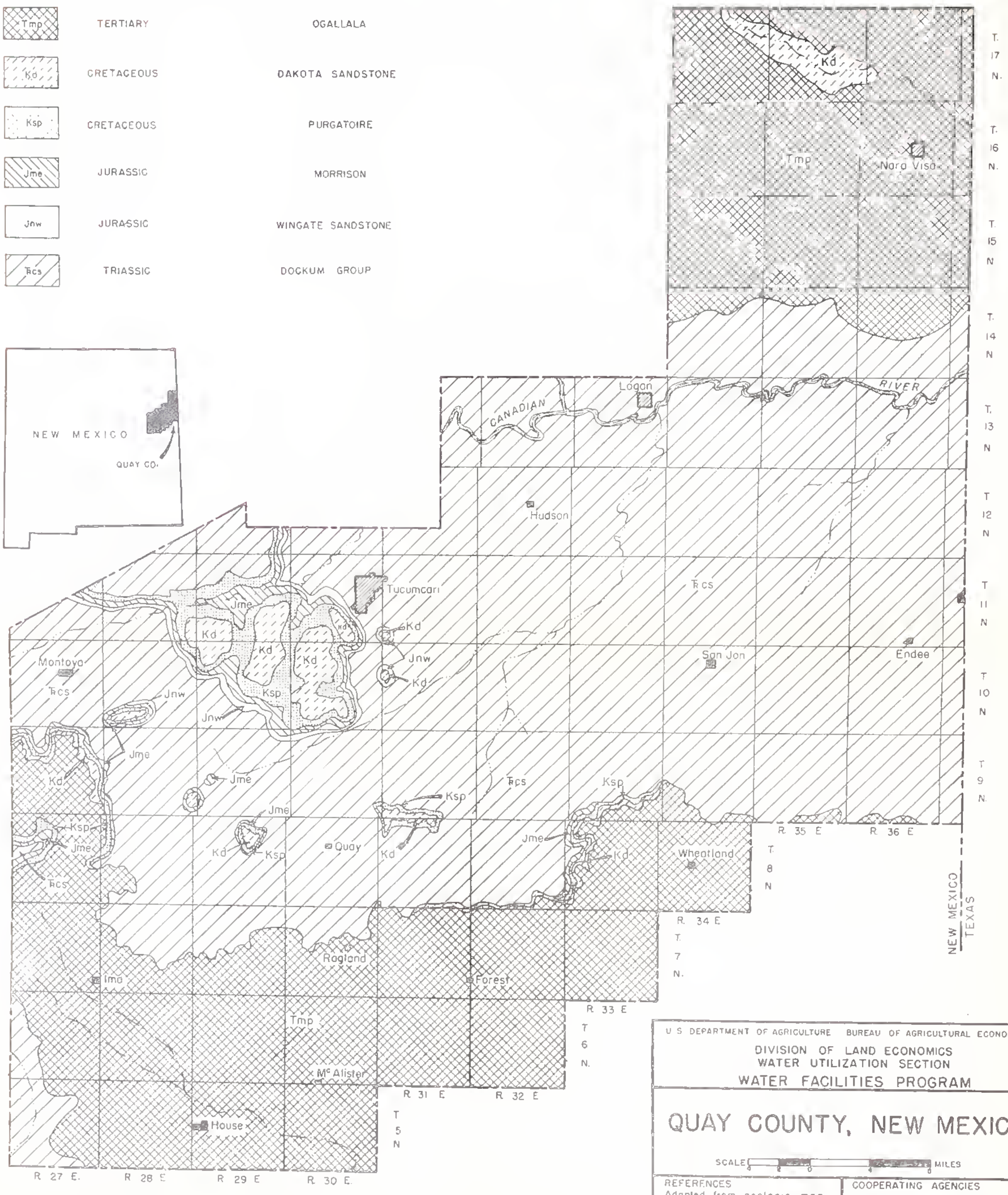
MAP I

QUAY COUNTY, NEW MEXICO

AREAL GEOLOGY

EXPLANATION

SYMBOL	AGE	FORMATION
Tmp	TERTIARY	OGALLALA
Kd	CRETACEOUS	DAKOTA SANDSTONE
Ksp	CRETACEOUS	PURGATOIRE
Jme	JURASSIC	MORRISON
Jnw	JURASSIC	WINGATE SANDSTONE
₸cs	TRIASSIC	DOCKUM GROUP



U S DEPARTMENT OF AGRICULTURE BUREAU OF AGRICULTURAL ECONOMICS

DIVISION OF LAND ECONOMICS
WATER UTILIZATION SECTION
WATER FACILITIES PROGRAM

QUAY COUNTY, NEW MEXICO

SCALE 0 2 4 6 8 MILES

REFERENCES	COOPERATING AGENCIES
Adapted from geologic map of New Mexico	NONE
DATE FEBRUARY 1942 MAP I	AREAL GEOLOGY

NEG. 40289

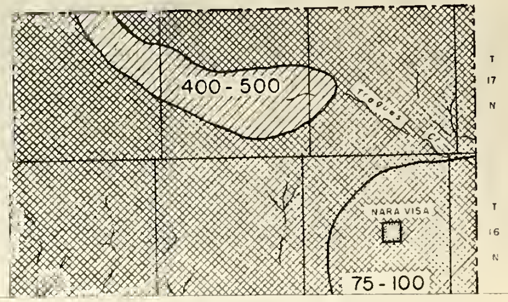
MAP 2

QUAY COUNTY NEW MEXICO

AVAILABILITY OF GROUND WATER

▨ AREAS WHERE POTABLE GROUND WATER SUPPLIES ARE GENERALLY AVAILABLE AT INDICATED DEPTHS. IN THESE AREAS EITHER RECENT OR TERTIARY DEPOSITS FORM THE LAND SURFACE AND ARE THE CHIEF AQUIFERS.

AREAS WHERE CRETACEOUS OR JURASSIC DEPOSITS ARE THE CHIEF AQUIFERS

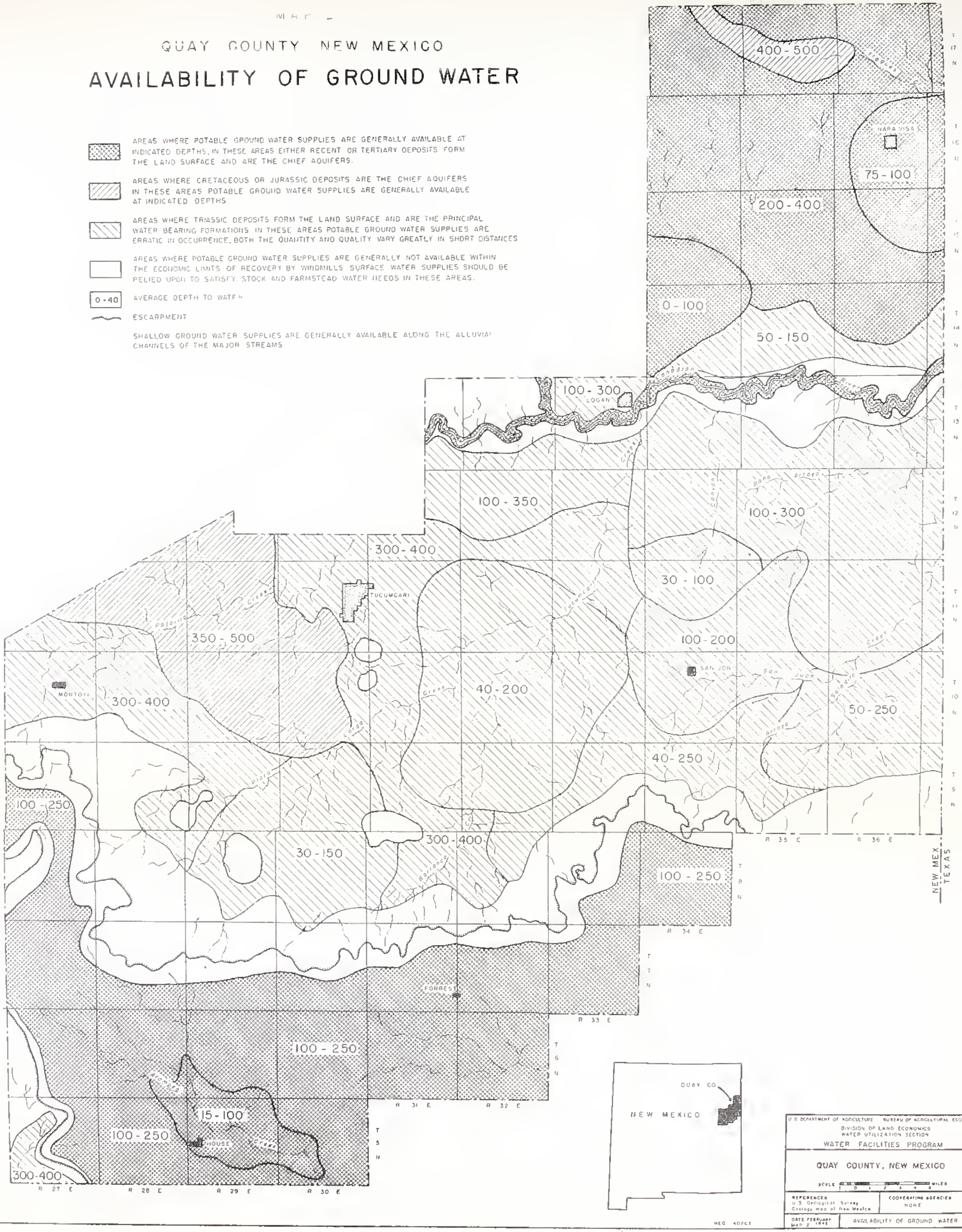


MAP

QUAY COUNTY NEW MEXICO

AVAILABILITY OF GROUND WATER

▩	AREAS WHERE POTABLE GROUND WATER SUPPLIES ARE GENERALLY AVAILABLE AT INDICATED DEPTHS, IN THESE AREAS EITHER RECENT OR TERTIARY DEPOSITS FORM THE LAND SURFACE AND ARE THE CHIEF AQUIFERS.
▨	AREAS WHERE CRETACEOUS OR JURASSIC DEPOSITS ARE THE CHIEF AQUIFERS IN THESE AREAS POTABLE GROUND WATER SUPPLIES ARE GENERALLY AVAILABLE AT INDICATED DEPTHS
▧	AREAS WHERE TRIASSIC DEPOSITS FORM THE LAND SURFACE AND ARE THE PRINCIPAL WATER BEARING FORMATIONS IN THESE AREAS POTABLE GROUND WATER SUPPLIES ARE ERRATIC IN OCCURRENCE, BOTH THE QUANTITY AND QUALITY VARY GREATLY IN SHORT DISTANCES
☐	AREAS WHERE POTABLE GROUND WATER SUPPLIES ARE GENERALLY NOT AVAILABLE WITHIN THE ECONOMIC LIMITS OF RECOVERY BY WINDMILLS SURFACE WATER SUPPLIES SHOULD BE RELIED UPON TO SATISFY STOCK AND FARMSTEAD WATER NEEDS IN THESE AREAS.
0-40	AVERAGE DEPTH TO WATER
〰	ESCARPMENT
	SHALLOW GROUND WATER SUPPLIES ARE GENERALLY AVAILABLE ALONG THE ALLUVIAL CHANNELS OF THE MAJOR STREAMS



NEG 40263

U S DEPARTMENT OF AGRICULTURE BUREAU OF AGRICULTURAL ECONOMICS
DIVISION OF LAND ECONOMICS
WATER UTILIZATION SECTION
WATER FACILITIES PROGRAM

QUAY COUNTY, NEW MEXICO

SCALE 1 0 1 2 3 4 5 MILES

REFERENCES
U S Geological Survey
Geology map of New Mexico

COOPERATING AGENCIES
NONE

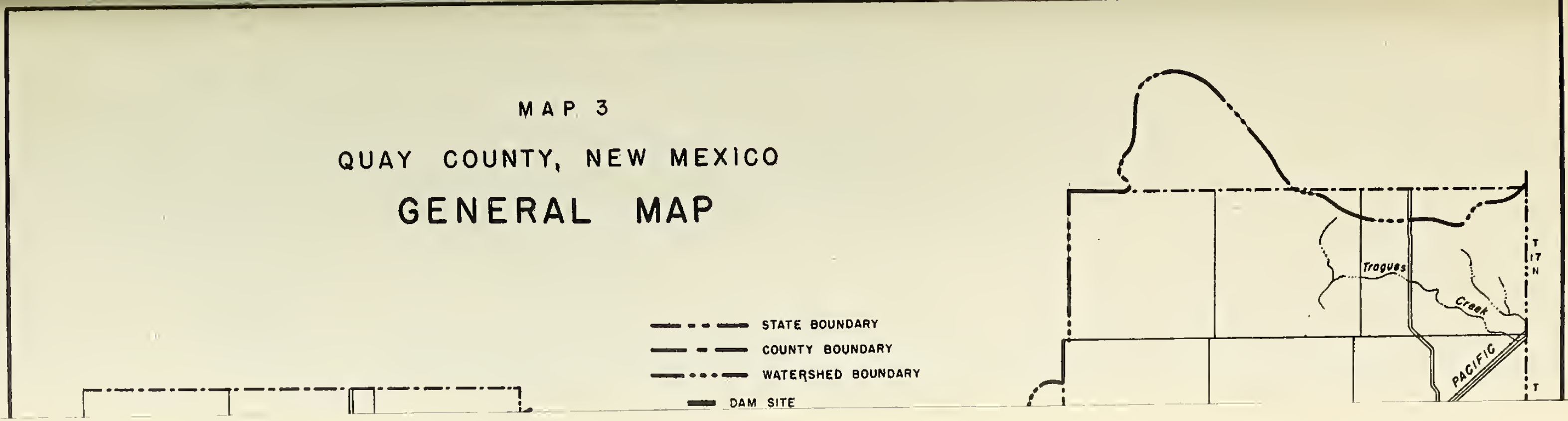
DATE FEBRUARY [illegible]
MAP 2

AVAILABILITY OF GROUND WATER

MAP 3

QUAY COUNTY, NEW MEXICO

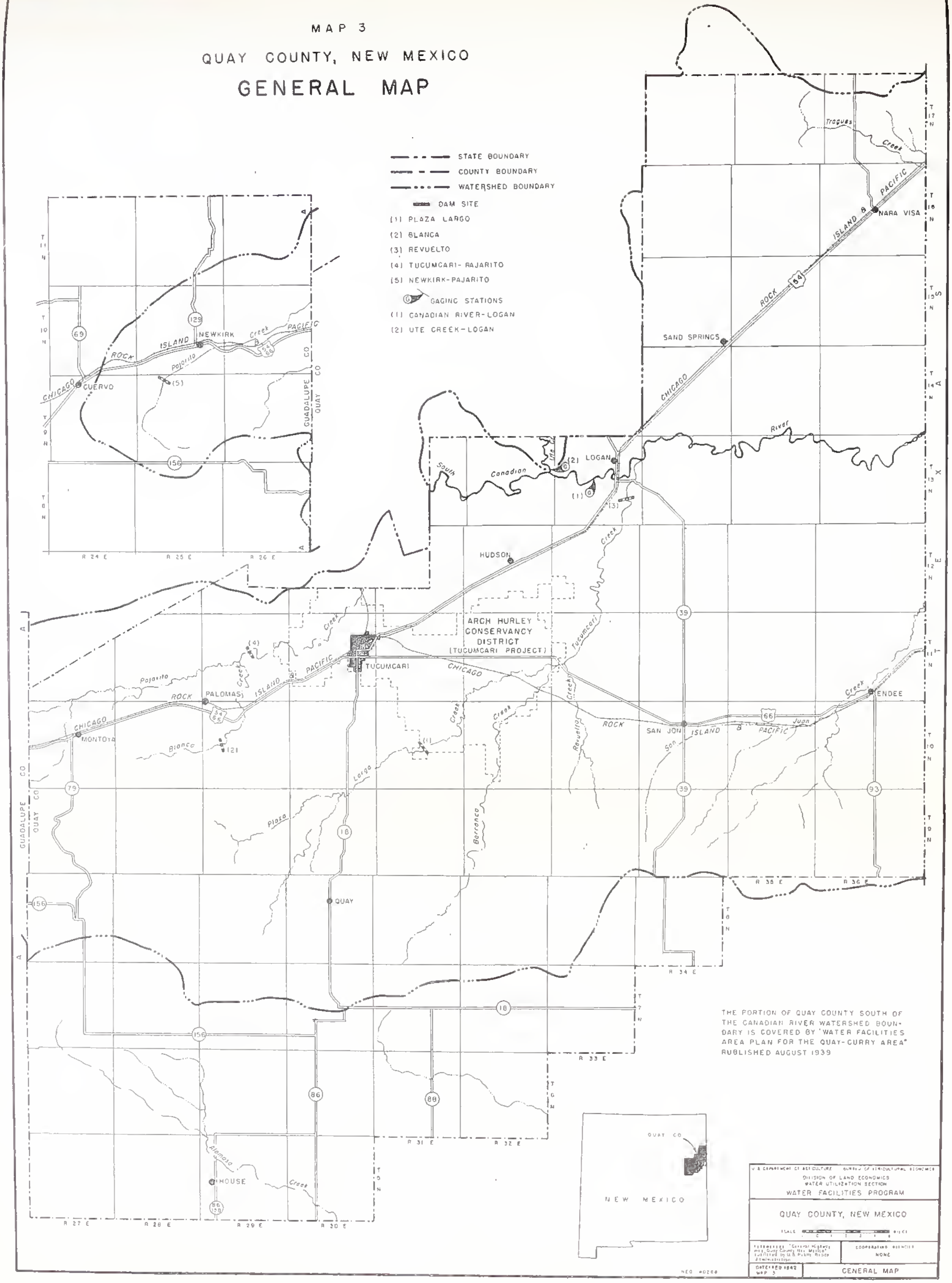
GENERAL MAP



MAP 3

QUAY COUNTY, NEW MEXICO

GENERAL MAP



THE PORTION OF QUAY COUNTY SOUTH OF THE CANADIAN RIVER WATERSHED BOUNDARY IS COVERED BY 'WATER FACILITIES AREA PLAN FOR THE QUAY-CURRY AREA' PUBLISHED AUGUST 1939

U.S. DEPARTMENT OF AGRICULTURE BUREAU OF AGRICULTURAL ECONOMICS
DIVISION OF LAND ECONOMICS
WATER UTILIZATION SECTION
WATER FACILITIES PROGRAM

QUAY COUNTY, NEW MEXICO

SCALE MILES

REFERENCES "General Highway map, Quay County, New Mexico" furnished by U.S. Public Roads Administration

COOPERATING AGENCIES
NONE

DATE FEB 1942
MAP 3

GENERAL MAP

NEG. #0200